US007628337B2

(12) **United States Patent**
Cuppetilli et al.

(10) **Patent No.: US 7,628,337 B2**
(45) **Date of Patent: Dec. 8, 2009**

(54) **SECONDARY HEATING SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 228 days.

(21) Appl. No.: **11/449,136**

(22) Filed: **Jun. 8, 2006**

(65) **Prior Publication Data**

US 2007/0284454 A1 Dec. 13, 2007

(51) **Int. Cl.**
F24D 3/08 (2006.01)
F24H 1/22 (2006.01)
F24D 19/10 (2006.01)

(52) **U.S. Cl.** ..... **237/19**; 237/2 A; 237/8 R; 237/48; 126/101

(58) **Field of Classification Search** ..... 237/19, 237/2 A, 46, 48, 8 R; 126/101, 99 R
See application file for complete search history.

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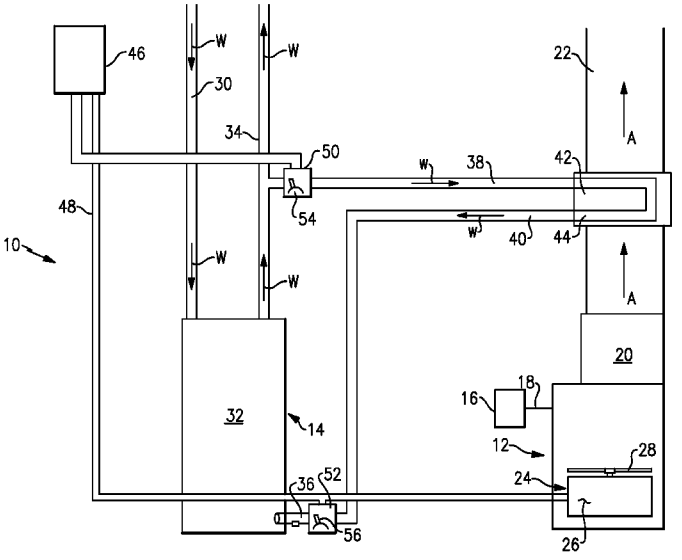
(57) **ABSTRACT**

A heating system operates in supplemental mode to carry water from a hot water supply of the water heater to a heat exchanger within an air passage in the furnace. A water return passage returns the water from the air passage back to the water heater. Air within the air passage passes through the heat exchanger and is heated from the water within. The water then returns to the water tank through a water return passage. A supplemental thermostat is connected to the system to control an air circulator for the furnace without requiring the furnace to be activated. The furnace will turn on and heat the air only if supplemental mode is not sufficient to maintain the desired temperature.

13 Claims, 1 Drawing Sheet



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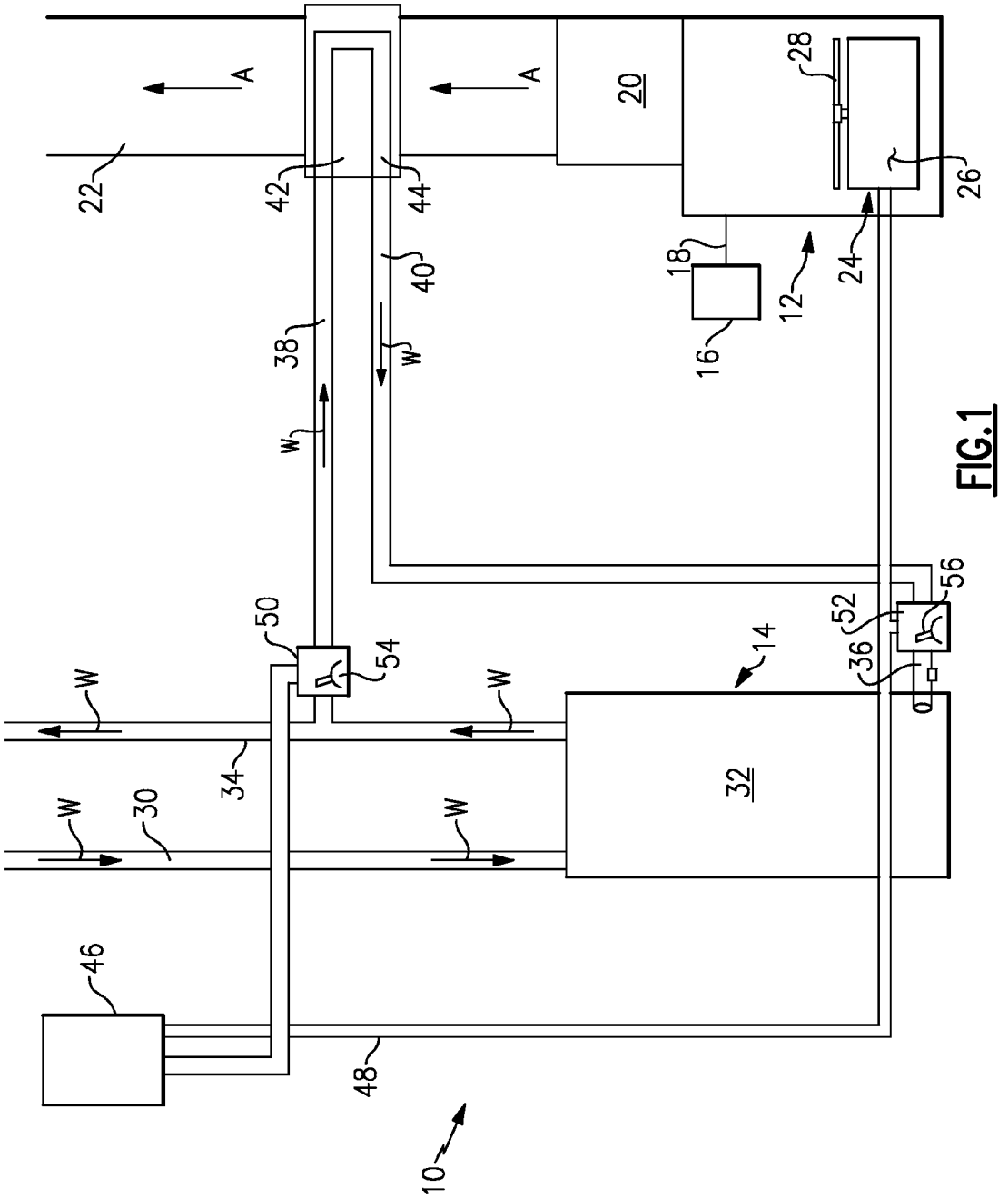
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FIG.1

SECONDARY HEATING SYSTEM

BACKGROUND OF THE INVENTION

This invention relates to a heating system. More particularly, this invention relates to a system for supplementing a main heating system.

Conventional heating systems for homes generally include a water heater and a furnace. The furnace typically provides hot air to warm the interior temperature of the house while the water heater provides hot water for the household. The energy requirements of the furnace are substantially greater than the energy requirements of the hot water heater. In addition, water temperatures are less affected by environmental changes than air within a house.

An apparatus and method for supplementing a furnace to heat a building while decreasing overall utility costs is needed.

SUMMARY OF THE INVENTION

A heating system operates in normal and supplemental modes to increase system efficiency and reduce overall cost.

A heating system for use in heating a residential dwelling includes a furnace and a water heater. In supplemental mode the system carries water from the hot water supply from the water heater to a heat exchanger within an air passage for the furnace. A water return passage returns the water from the air passage back to the water heater. Air within the air passage passes through the heat exchanger and is heated from the water within. The water then returns to the water tank through a water return passage.

A supplemental thermostat is connected to the system to control an air circulator for the furnace without requiring the furnace to be activated. In supplemental mode the air circulator operates at a reduced speed compared to the speed when in normal mode such that, the system is continuing to warm the air enough to maintain the temperature without cycling on and off. A main thermostat, for the furnace, would preferably be set at a lower desired temperature than the supplemental thermostat. Thus, the system will only operate in normal mode if supplemental mode is not sufficient to maintain the desired temperature.

These and other features of the present invention can be best understood from the following specification and drawings, the following of which is a brief description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic illustration of an example heating system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A heating and cooling system **10** (or "HVAC system") is shown schematically in FIG. **1**. The system **10** is preferably for use in heating a home or other residential dwelling. The system **10** includes a furnace **12** and a water heater **14**. The furnace **12** and water heater **14** may operate on natural gas, electricity, oil or any available energy source. The furnace **12** has a thermostat **16** to control furnace operation and a control line **18** to connect the thermostat **16** to the furnace **12**. The thermostat **16** is mounted within the house remote from the furnace **12** in an easily accessible area to the user. The system **10** may also include an air conditioner **20** attached to the furnace **12**, so that the system can provide hot and cool air for the home. An air passage **22** extends from the furnace **12** to carry the heated or cooled air (airflow indicated with arrow A) through the home.

An air circulator **24** incorporated in the furnace **12** controls the airflow through the air passage **22** and includes a control **26** to control the volume of air that is circulated through the home. Typically the air circulator **24** includes a fan **28**. The speed of the fan **28** is set by the control **26** which receives input from the thermostat **16** to turn the fan **28** on or off or adjust a variable speed.

The water heater **14** includes a cold water supply **30** leading into a water tank **32** and a hot water supply **34** leading from the water tank **32**. Water, indicated by arrow W, from the ground supply enters the water tank **32** through the cold water supply **30**. The water is heated within the water tank **32** and exits through the hot water supply **34** to be distributed at desired locations throughout the house. The water heater **14** also includes a water tank drain valve **36**. The water tank drain valve **36** is normally used to drain water from the tank **32** during maintenance or repair. During typical operation of the water heater **14** the water tank drain valve **36** is closed to retain the water within the water tank **32**.

During normal system **10** operation the furnace **12** receives a control input from the thermostat **16** based upon the desired interior temperature of the home and the actual interior temperature of the home. When the difference in temperature has reached a predetermined level the system **10** is activated to either warm or cool the air. The air is distributed through the home through the air passage **22** until the thermostat **16** senses the actual interior temperature is the same as the desired interior temperature. Activating the furnace **12** requires power to heat the air and to activate the air circulator **24** to distribute the air. The fan **28** may have one operating speed or may be variable speed, and is either rotating or stationary.

When difference between the actual home temperature and the desired home temperature is large enough to require heating the home, but not large enough to require the furnace **12**, the system **10** operates in supplemental mode.

A water supply passage **38** carries water from the water heater **14** to the air passage **22** for the furnace **12**. The water supply passage **38** is connected to the hot water supply **34** leading from the water tank **32** to the house. Thus, the water within the water supply passage **38** has been heated by the water heater **14**. A water return passage **40** returns the water from the air passage **22** back to the water heater **14**. The water return passage **40** preferably is connected to the water tank **32** at the water drain valve **36**. The water return passage may be connected to the water tank **32** in another manner that allows water to return to the water tank **32**, but is preferably connected at a lower end of the water tank **32**.

The water passes through the water supply passage **38** to a heat exchanger **42** within the air passage **22**. Air within the air passage **22** passes through the heat exchanger **42** and is heated from the water within the heat exchanger **42**. The water then returns to the water tank **32** through the water return passage **40**. The heat exchanger **42** is preferably a water coil heat exchanger. Water coil heat exchangers are specifically designed for carrying water through the heater exchanger coils **44**. The coils **44** are typically copper and aluminum, or entirely aluminum.

A supplemental thermostat **46** is connected to the air circulator **24**. A supplemental control line **48** also leads to the air circulator **24**. The supplemental control line **48** is separate from the main control line **18**. The supplemental thermostat **46** and control line **48** allow the air circulator **24** to be controlled in supplemental mode without requiring the furnace

12 to be activated. The air circulator 24 is used to activate the fan 28 and create air flow through the air passage 22 when in the supplemental mode. In supplemental mode the fan 28 will operate at a reduced speed compared to the fan speed when in normal mode. If the control 26 for the fan 28 does not provide variable speed capability, a rheostat or other power control can be added so that the speed of the fan 28 is reduced in supplemental mode. Optionally, in some situations, the fan 28 may not be necessary in supplemental mode, as the air may circulate sufficiently purely by convection.

The supplemental thermostat 46 is set at a desired temperature. When the actual temperature drops below the desired temperature, as sensed by the supplemental thermostat 46, water is passed through the supply passage 38 to the heat exchanger 42. The thermostat sends a signal to the air circulator 24 to begin fan 28 operation. The supplemental thermostat 46 is connected to an electric supply valve 50 and an electric return valve 52. The thermostat 46 can shut off water flow through the supply passage 38 and return passage 40 when the actual temperature is the same as the desired temperature. Preferably, the fan speed 28 is set at low revolutions per minute such that, in supplemental mode, the system 10 is continuing to warm the air enough to maintain the temperature without cycling the system on and off. The main thermostat 16 would preferably be set at a lower desired temperature than the supplemental thermostat 46. Thus, the system will only operate in normal mode if supplemental mode is not sufficient to maintain the desired temperature. The system 10 could operate in both normal mode and supplemental mode at the same time. In other words, the supplemental mode continues to operate when the normal mode is switched on.

By maintaining a desired temperature with the system 10 in supplemental mode, operation of the furnace 12 is reduced. The reduced operation of the furnace 12 saves on energy costs for the system 10.

Manual supply valve 54 can be used to override the system 10 and prevent water flow through the supply passage 38. Likewise, manual return valve 56 can be used to override the system 10 and prevent water flow through the return passage 40. The manual valves 54, 56 can be used to prevent water flow to the system 10 in warmer months.

Although a preferred embodiment of this invention has been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.

What is claimed is:

1. A heating system comprising:
- a furnace having an air circulator and a heat exchanger;
- a water heater having a hot water supply and a cold water supply;
- a supply passage connecting the water heater to the heat exchanger, for conveying water from the water heater to the furnace;
- a return passage connecting the heat exchanger to a lower end of the water heater at a location that is independent from the cold water supply, for returning the water to the water heater, wherein water within the supply passage has a higher temperature than air within the furnace, such that the temperature of the air increases when the air passes through the heat exchanger;
- a control to control water flow within the supply passage and water flow within the return passage, wherein the water in the supply passage has a first temperature and the water within the return passage has a second temperature, the first temperature greater than the second temperature, the control includes an electronic shut off valve to prevent water flow through the supply passage and the return passage based upon an air temperature in a building reaching a first threshold air temperature, the control switching on the furnace based upon a second threshold air temperature in the building, lower than the first threshold air temperature.

2. The heating system of claim 1, wherein the a control controls the air circulator.

3. The heating system of claim 2, wherein the air circulator includes a fan and the control is connected to the fan to control a fan speed, and wherein the fan speed is lower when the furnace is off than when the furnace is on.

4. The heating system of claim 2 wherein the control includes a supplemental thermostat, the system further including a main thermostat for controlling the furnace.

5. The heating system of claim 1 further including a manual shut off valve on the supply passage to close the supply passage to the heat exchanger and a manual shut off valve on the return passage to close the return passage to the water heater.

6. The heating system of claim 1, wherein the heat exchanger is a water coil heat exchanger.

7. The heating system of claim 6, wherein the heat exchanger includes aluminum coils.

8. The heating system of claim 6, wherein the heat exchanger includes aluminum and copper coils.

9. A heating and cooling system comprising:
- a furnace having an air circulator and a heat exchanger;
- a supply passage connecting a water heater to the furnace, for conveying water from the water heater to the furnace;
- a return passage connecting the furnace to the water heater, for returning the water to the water heater, wherein the return passage is connected to a drain of the water heater; and
- a control to control the air circulator, water flow within the supply passage and water flow within the return passage, wherein the water in the supply passage has a first temperature and the water within the return passage has a second temperature, the first temperature greater than the second temperature,
- the control includes an electronic shut off valve to prevent water flow through the supply passage and the return passage based upon an air temperature in a building reaching a first threshold air temperature, the control switching on the furnace based upon a second threshold air temperature in the building, lower than the first threshold air temperature.

10. The heating system of claim 9, wherein the air circulator includes a fan and the control is connected to the fan to control a fan speed, wherein the fan speed is lower when the furnace is off than when the furnace is on.

11. The heating system of claim 9, comprising a manual shut off valve on the supply passage, wherein the manual shut off valve closes the supply passage to the furnace.

12. A method of heating a building comprising:
- a) flowing water from a water heater through a supply passage and through a heat exchanger within an HVAC system air passage to increase the temperature of the air within the HVAC system air passage, wherein the water has a temperature higher than a temperature of the air, the water heater including a cold water supply and a hot water supply;
- b) returning the water from the heat exchanger to the water heater through a return passage, the return passage being connected to a lower end of the water heater independently from the cold water supply;
- c) circulating the air between the HVAC system air passage and the building;
- d) preventing water flow through the supply passage and the return passage with an electronic shut off valve based

upon an air temperature in the building reaching a first threshold air temperature; and

e) controlling operation of a furnace within the HVAC system based upon a second threshold air temperature in the building, lower than the first threshold air temperature.

13. The method of claim **12**, further including the step of:

d) decreasing a fan speed for circulating the air in said step c) when the furnace is off and increasing the fan speed when the furnace is on.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,628,337 B2
APPLICATION NO. : 11/449136
DATED : December 8, 2009
INVENTOR(S) : Cuppetilli et al.

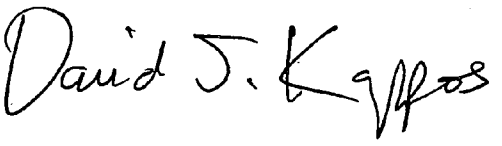
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claim 2, Column 4, Line 6, delete "a" between "the" and "control"

Claim 13, Column 6, Line 2, replace "d)" with "f)"

Signed and Sealed this

Twelfth Day of January, 2010



David J. Kappos
Director of the United States Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,628,337 B2
APPLICATION NO. : 11/449136
DATED : December 8, 2009
INVENTOR(S) : Cuppetilli et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

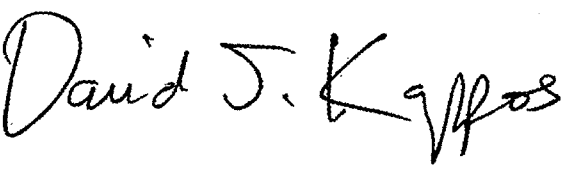
On the Title Page:

The first or sole Notice should read --

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 388 days.

Signed and Sealed this

Twenty-first Day of December, 2010



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